Numeracy into action: Putting numeracy research into practice

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Abstract

In 2014 the National Adult Literacy Agency (NALA) published a research report titled What really counts next: action learning project with numeracy tutors (Sellers and Byrne, 2014). The report provided an in-depth insight into the way tutors made changes to their practice, and offered practical tips on how to teach numeracy to adult learners in order to support their numeracy development. This article summarises the main findings from the report and provides two mini case studies showcasing numeracy work in action.

Key words: (Numeracy, Literacy, Research, Practice, Teaching strategies)

Introduction

In 1997 the publication of the OECD International Adult Literacy Survey (IALS) showed that in Ireland 25% of the population between the ages of 16–64 performed at the lowest level of a five point scale of literacy and numeracy skills (Morgan *et al,* 1997). In 2012 the results of the OECD Programme for the International Assessment of Adult Competencies (PIAAC) showed that just over a quarter of Irish adults score at or below level 1 for numeracy (25.6%) whilst one in six (17.9%) scored at or below level 1 for literacy (CSO, 2012). In 2013 a review of the adult literacy service in Ireland recommended that numeracy should be strongly promoted as an option for adult learners and participation should be increased in both standalone and integrated numeracy programmes (DES, 2013). During 2014 two major publications were launched that focus on the development of further education and training in Ireland. Further Education and Training in Ireland: Past, Present and Future (ESRI, 2014) and the Further Education and Training (FET) Strategy 2014–2019 (SOLAS 2014). The ESRI report sets out the historical evolution of further edu-

cation and training provision in Ireland. The FET Strategy contains objectives that promote literacy and numeracy across FET

To date, there is a dearth of research into adult numeracy practice in Ireland. Therefore, we know very little about the teaching methodologies and pedagogical approaches of adult numeracy tutors. Adult literacy and numeracy tutors belong to a distinct community of practice, yet unlike many educators, they get few opportunities to learn from observing each other (Lave and Wenger, 1991). In recent years, NALA embarked on a programme of research that sought to capture teaching in literacy and numeracy practice. The research used a case study methodology to examine the teaching approaches and strategies used by adult literacy and numeracy tutors in their day to day work.

In 2013 NALA published *What really counts: case studies of adult numeracy practice in Ireland* (Byrne and Sellers, 2013). The research recorded the numeracy teaching practice of five tutors working around Ireland. It looked at their 'general teaching approaches' (how they used questioning, problem solving, context and collaborative learning), and their 'topic specific' approaches (for example, how they taught measurement or percentages). All of the 'topic specific' teaching strategies were collated in a practice table at the back of the report. Keen to maximise the impact of the research a follow up Action Learning Project (ALP) based on the case studies was carried out in 2014. The ALP sought to gather information about the immediate impact of the case study research, by trialling the practice described in the report with numeracy tutors. Participation in the ALP provided an opportunity for tutors to develop new knowledge and skills to improve how they teach numeracy, and produce further teaching and learning ideas and resources to share with other practitioners. Thirteen tutors took part in the project and the findings were published in the report *What really counts next: Action learning project with numeracy tutors* (Sellers and Byrne, 2014).

Findings

Tutors reported that they saw the action learning project as an opportunity to become more innovative in their approaches to teaching numeracy to adults. Some used strategies and resources that they identified in *What really counts* (Byrne and Sellers, 2013) to teach topics that they knew their learners struggled with, such as algebra or measuring circles. Others used ideas for games and group activities to motivate learners. Tutors were also keen to challenge themselves to experiment in the classroom.

The reasons tutors gave for their choices revealed that they had reflected on their own practice and their motives for their choices. It also showed that they were genuinely open to develop their professional practice. This commitment to self-challenge is evident in the remarks from a tutor who was keen to write stronger lesson plans:

> The use of questioning, problem-based learning activities, meaningful contexts, technology … other than technology I had not consciously ensured I looked at building these practices into my lesson plans.

The project was designed to stimulate personal and shared reflections, and encouraged tutors to think about making changes to the practice in the longer term. One tutor, reflecting on her use of iPads and apps with the learners reported:

> I would like to try to introduce a topic using the iPads, because up to now I have only used them at the end of a topic to reinforce learning.

Another tutor saw potential for using activities with a bigger group:

> I would split the group into small groups to discuss and come up with the answers as a group instead of struggling on their own. I think if given the opportunity to ponder the questions and discuss as a group they might understanding better.

The tutors concluded that implementing practice from *What really counts* (Byrne and Sellers, 2013) helped generate new ideas in how to teach particular topics, including using innovative or creative strategies and applying strategies to topics other than those they were designed for. They also felt they were more ready to make use of online learning resources and develop new resources themselves, including those for ESOL learners. They felt as well that the project enabled them to change their teaching more fundamentally, for example by using questioning more strategically.

Teaching strategies and resources

The tutors considered their use of teaching strategies and resources and made commitments to utilise these more effectively to improve their practice. For example, they committed to incorporate more technology into classes and to bring more variation into the classes in terms of teaching strategies. Others planned to use more probing questions to encourage critical thinking by the

learners – and to allow time for learners to answer. Another committed to encourage group discussion so that learners might solve problems for themselves.

Reflective practice

The tutors reflected on assumptions they made about what learners already know, understand and can do – and how this impacted on their practice. One tutor reflected on assumptions she made when teaching ESOL learners:

> Although I was aware of needing not to make assumptions, I still made assumptions about how money is represented in numbers … I had not thought about how different countries in Africa might have different numbering systems. I also assumed that because the learners could recognise the numbers easily that they would be able to form the numbers easily too.

Tutors also reflected on their perceptions of themselves as tutors and identified where their strengths, interests, enthusiasm and enjoyment lay and how these informed their approach to teaching. For example one tutor explained how she believes she teaches numeracy using a constructivist approach, encouraging learners to ask questions and work in a collaborative way with each other. She reported that this way of teaching numeracy was very different to how she was taught mathematics in formal education.

When reflecting on their approach to teaching numeracy to adult learners many of the tutors realised that while they had 'enjoyed learning maths', their experience might not necessarily tally with the experiences of their learners.

Continuing professional development

Some of the tutors reported that they were more confident teaching literacy then numeracy. They said that they had less experience as numeracy tutors and would like to take part in more professional development to increase their confidence and competence in this area. According to the tutors the areas they gained the most from in terms of professional development were the use of 'teachable moments', the use of questioning, the importance of meaningful contexts, and the specific teaching strategies relating to individual numeracy topics. They also cited the importance of taking time to read relevant up to date materials such as the *What really counts* (Byrne and Sellers, 2013) case studies published by NALA. One tutor commented that she felt that, for her, the real value of the *What really counts* (Byrne and Sellers, 2013) case studies was not so much the

practice table at the back of the report, but the in-depth case studies themselves, which enabled her to understand the practice in context.

The importance of networking

The tutors commented repeatedly on the importance and value of networking with other tutors. They said that they would welcome more opportunities to meet other tutors, share ideas and resources, ask for advice and support one another in their practice.

In order to facilitate 'networking' among the group of tutors the project team set up a Facebook 'closed group', which is a private online social media group. Six of the tutors joined up but the majority of the tutors felt uncomfortable setting up a profile on Facebook. They said they would have preferred an online group away from Facebook; for example, a dedicated Moodle page, or a forum on NALA's Tutors' Corner webpage.

Two examples of tutors' project work[1]

1. Teaching basic number principles to ESOL learners
Tutor: Clare Hatcher, Cork Education and Training Board.

Clare worked with ESOL learners with little mathematics education. She realised that some learners had difficulty carrying out tasks such as drawing a triangle and dealing with basic numbers.

She was keen to find out how useful 'manipulatives' might be in building understanding of basic concepts, such as adding whole numbers and place value. She says, 'I began thinking about how manipulatives might really help basic learners with maths in the same way that cutting writing into phrases, sentences and words helps with literacy.'

Clare used the manipulatives with her learners for four weeks, for two hours a weeks. She began with a needs assessment. Her two learners could recognise numbers and could do simple addition, but were unsure about signs.

Number line and dice

Clare used a number line to check whether the learners could add up two numbers. She then introduced dice. Both learners had seen dice before but were not

1 With thanks to the tutors for their permission to include reference to their work.

familiar with them. One of the learners had been tricked out of money with dice and avoided them since. The learners initially struggled to read the dots as numbers. They used the dice for addition up to 12. Clare asked the learners to think of a number between 2 and 12 and roll the dice to see if they could match the number. This ways she could check the learners understood the dots on the dice and could add them successfully. She gave the learners dice to play with at home with their children.

She then brought out a cardboard place value chart with cardboard numbers to put the dice numbers on. The learners could place the cardboard numbers from 2–12 on the chart correctly but there was conceptual difficulty with placing 1.

Clare wanted to consolidate the learners' ability to recognise dots as numbers, and to write and draw numbers. She used a sheet from *The Numeracy Pack* (Coben and Black, 2005) to help with this. From the same pack Clare gave both learners a tracing worksheet to practice writing numerals and the numbers as words.

Language of mathematics

Clare introduced the 'language of maths' so that the learners could understand and use the same language as their children learned in school.

Using money to build understanding of numbers

Clare gave the learners 5c, 2c and 1c coins and asked them to see how many ways they could make the coins add up to 7. The learners worked easily with the coins. Progress was slower when the tutor asked them to complete a worksheet based on 7. They appeared to have difficulty noticing the emerging pattern that each calculation resulted in 7.

Clare built on the place value chart by asking the learners to place two-digit and then three-digit numbers on the chart. She then gave them three numbers and asked them to make the biggest number possible. She asked them to explain their choice by using the basic place value chart.

The place value chart led one learner to ask about money and specifically what 'the dot' (decimal point) meant and why 'it moved'. The second learner had not heard of the decimal point, but had noticed it.

A misconception arose when the learner told Clare that her son's favourite crisps cost 99. She had asked an assistant who told her that meant €1. When

Clare looked at the signs in the supermarket advertising booklets which the learner had brought in, she realised that it would be possible to misunderstand 99c without the cultural context of understanding what that means. Clare realised that goods are priced at, for example, 49c and €6 and so are frequently written without using the decimal point. She struggled to explain this very well. She worked with the learners and reached an understanding about coins (cents) being part of the whole (euro). Clare encouraged the learners to look for the difference in the way amounts under €1 and over €1 are displayed in the shops.

2. Using reflective discussion with learners
Tutor: Angela Cahill, Louth & Meath Education and Training Board

Angela applied the 'spaced learning' idea from *What really counts* (Byrne and Sellers, 2013). She had already covered circumference and area of a circle with her group and three learners in the group were struggling with these principles and calculations. She hoped this exercise would make the theory more tangible. On this occasion she asked her learners to measure the diameter of car tyres. She split the group into three pairs and left out three different measuring 'tapes' – a sewing tape, a piece of string and a paper tape from 'Safefood', which measured only in inches.

Angela then asked the learners to go outside to the car park. The learners brought the measurements back and used them to work out each wheel's circumference. They then went back outside and measured the circumference and came back to the classroom and compared the measured circumference to the calculated circumference.

Angela led a discussion following the class and recorded it. The learners made several very interesting comments and lots of questions arose, around the accuracy of the measuring tape (and whether it measured in centimetres or only inches), and the reliability of calculators.

Angela believes that for learners who had already grasped the concepts, there had not been any new learning in this exercise. However, the subsequent discussion opened up ideas that were useful for all the learners, particularly on sources of error when measuring and the fallibility of the calculator. She says, 'Using the Safefood tape I initially thought was a bad idea given it only did inches but it resulted in some interesting insights.' In future Angela says that she would use the exercise earlier in her unit on measurement.

Angela believes that this idea could be extended to other 2D shapes and also volume (for example, by asking learners to measure the dimensions of a milk carton and work out how much milk it held). She also suggests not using measuring tapes with the tyres and asking the group to work out how to measure a curved surface.

As a further exercise, Angela gave each learner a map with a scale and asked them to work out the distance from one place to another. The learners struggled as the scale given resulted in an awkward calculation. Angela decided to change the exercise to plan furniture in a living room. This was to make the concept of scale more real-life-based and authentic. She gave the group 1cm2 paper and explained to them that they had a living room, 6m by 5m in size. She gave them an Argos catalogue and asked them to draw the room and to furnish it.

The group of five learners worked in two sub-groups and had to choose a scale themselves. At first they had difficulty, so Angela asked them to think about what size the drawing would be if they chose a 1cm = 1m scale. Someone suggested a 1cm = 3m scale which would have resulted in an even smaller room. By showing what these scales looked like one person realised that they needed to go to fractions of metres, for example 1cm = 0.5m. After some thought and discussion the group decided to use a scale where 1cm = 0.25m. As they chose furniture the learners realised that they had to scale the measurements for the furniture as well. The learners collaborated and the two sub-groups became mildly competitive as they compared who had chosen the best quality furniture, or the best positioning of the furniture.

Following the session, the learners told Angela that they would have felt lost if they'd had to work on their own, and that they had learned from working together.

The learners also made suggestions for other ways in which the tutor might use this task to teach numeracy. They offered ideas such as: asking the learners to price all the furniture, asking the group to design the room within a budget, and adding in sale reductions (%) and furniture delivery charges

Conclusions

Overall, the action learning project was a success. The tutors reported that taking part in the action learning project had inspired them to integrate numeracy as part of their literacy programmes and provided them with creative ideas

to use in the classroom. It had made them question their assumptions about learners and their learning needs, enabled them to 'rediscover' their learning philosophies and encouraged them to reflect on aspects of their practice and on their perception of themselves as professionals. Ultimately they said they had benefited from an unexpected opportunity to take part in continuing professional development and to network with other tutors.

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